

REMARKS/ARGUMENTS

The examiner is thanked for thoroughly reviewing the subject patent application and Applicant's arguments, filed 6/3/05, in response to the previous Office Action. Applicants will not repeat their summary of the claimed invention, since they believe it was adequately set forth in their previous response. However, since the remaining issue is one of double patenting, Applicants would like to more carefully reiterate their argument as to the patentable differences between the present claimed invention and the invention described and claimed in copending Application No. 10/872915.

The present claimed invention achieves a uni-axial magnetic anisotropy in the free layer of an MTJ cell without the necessity of patterning that cell to have a non-circular cross-section. It is well known in the art that magnetic anisotropy can be obtained in the form of shape anisotropy, by patterning the cell in, for example, an elliptical shape. In the present claimed invention, the more easily produced circular cross-section is retained, while the anisotropy is produced by forming an antiferromagnetic layer on top of the free layer. This layer, which is referred to as the "top antiferromagnetic layer" in amended claim 1, after an annealing process, couples magnetically with the free layer to produce the desired anisotropy. This top antiferromagnetic layer is not to be confused with the "antiferromagnetic pinning layer" recited in line 9 of amended claim 1, which is a pinning layer for the cell's pinned layer.

The invention described and claimed in 10/872915 provides a magnetic anisotropy to the free layer of an MTJ cell by means of the composite bit line that is formed above it. The bit line is clad with a soft magnetic layer (not an antiferromagnetic layer) and it is that cladding which provides the anisotropy. This bit line is external to the cell and is not a part of the cell. If the bit line were not formed, the cell by itself would possess no magnetic anisotropy in its free layer. The cell of the present claimed invention, on the other hand, does not need a bit line of any particular construction to provide anisotropy. The magnetic anisotropy has been built into the cell by means of the antiferromagnetic layer that is coupled to the free layer. In short, the cell of the present claimed invention is intrinsically and inherently magnetically anisotropic. It needs no bit line construction to provide that anisotropy.

Careful consideration of Claim 17 (copied below) of the copending Application reveals the difference between it and claim 1 of the present claimed invention:

17. A method of forming a thermally stable and easily switchable MTJ MRAM cell comprising:

providing a substrate;

forming a composite bit line on said substrate, said bit line extending in a first direction in a horizontal plane and said bit line including an adjacent soft magnetic layer (SAL);

forming a multilayered magnetic tunnel junction (MTJ) element on said bit line, said element including a magnetically pinned layer and a magnetically free layer which is proximate to said SAL and is magnetically coupled to said SAL;

patterning said MTJ element to form a horizontal cross-sectional shape which is circular or elliptical with low aspect ratio less than 2;

annealing said MTJ element to pin said pinned layer to an adjacent antiferromagnetic pinning layer;

forming a write word line above said MTJ element, said write word line being in a horizontal plane and extending in a second direction which is perpendicular to said first direction and said write word line being electrically insulated from said MTJ element.

Examiner asserts that “Claims 17, 21 and 23 of 10/872915 application disclose the required coupling to the antiferromagnetic layer.” As can be seen from base claim 17 above, the only mention of an antiferromagnetic layer is in line 13: “annealing said MTJ element to pin said pinned layer to an adjacent antiferromagnetic pinning layer;” which refers to the standard pinning of the MTJ cell’s pinned layer by an antiferromagnetic layer. This pinning layer is analogous to the “antiferromagnetic pinning layer” recited in amended line 9 of amended claim 1 of the present claimed invention. There is no mention of an antiferromagnetic layer coupling to the free layer, which is the “top antiferromagnetic layer” recited in amended claim 1 of the present claimed invention on line 14. Similarly, claims 21 and 23 refer only to the antiferromagnetic pinning layer, not to an antiferromagnetic layer coupled to the free layer. It is possible that there was confusion between (original) claim 1 of the present claimed invention, which recites both a top and bottom antiferromagnetic layer and claim 17 of the copending application, which recites only an antiferromagnetic pinning layer. It is the top layer of claim 1 that is absent in claim 17 of the copending application. To more clearly describe the claimed

invention, claim 1 has been amended to recite that the bottom antiferromagnetic layer is a pinning layer and to further recite the top antiferromagnetic layer in the claim preamble.

Applicants, therefore, wish to repeat their previous argument that the subject Application and the copending Application refer to inventions that are patentably different and that, as a consequence, the rejection on the basis of nonstatutory double patenting should be reconsidered.

Provisional Claim Rejections Under Obviousness-Type Double Patenting.

Applicants respectfully request the reconsideration of the rejection of amended claim 1 and claim 3 as being unpatentable over claims 17, 21 and 23 in co-pending Application No. 10/872,915, assigned to the same assignee as the present application. Applicants would respectfully argue that the conflicting claims are patentably distinct from each other and that, therefore, they do not warrant a rejection under the judicially created doctrine of obviousness-type double patenting. Applicants would also respectfully request that the remaining claims 2, and 4-14, which are objected to, are also allowable as depending from allowable claims.

Applicants would respectfully suggest that amended claim 1 of the present claimed invention, which recites a top layer of antiferromagnetic material that is exchange coupled to a ferromagnetic free layer beneath it by an annealing process, is patentably distinct from claim 17 of the co-pending application which does not recite such a coupled combination. Conversely, the invention claimed in the present application does not recite a bit line with an SAL, as is claimed in the co-pending application.

Applicants would further respectfully argue that the present claimed invention is not suggested by the invention in the co-pending application and, therefore, that the present claims 1-14 do not constitute non-statutory double patenting.

Conclusion

The Examiner is thanked for thoroughly reviewing the application. All claims discussed above are now believed to be allowable. If the Examiner has any questions regarding the above application, please call the undersigned attorney at 845-452-5863

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'SBA', with a stylized flourish extending to the right.

Stephen B. Ackerman, Reg. No. 37,761